NPIC/TSG-131-70

MEMORANDUM FOR: Director, National Photographic Interpretation Center

SUBJECT : Request for Approval of a Contract for the Testing and Fabrication of a Prototype Device for the Calibration of the High Precision Stereo Comparator for [redacted] from FY 1971 R&D Funds

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1. This memorandum requests approval for the commitment of R&D funds for an NPIC contract. The specific request is stated in paragraph 9.

2. The High Precision Stereo Comparator (HPSC) presently under development is scheduled to be in operation at NPIC by early 1971. This sophisticated comparator provides stereoscopic measurements accurate to a fraction of a micrometer (micron) by means of a laser interferometer measuring system. While the interferometer incorporated in the HPSC is one of the most accurate and reliable measurement systems known, thermal drift and machine variations can affect the critical measurement outputs of the comparator over an extended period of time. Therefore, the machine must be periodically checked against a known standard.

3. There presently are scales of one micrometer accuracy that can be used for the calibration of operational comparators in NPIC, but there is no existing technique to check comparator accuracies in the submicrometer region. In addition, [redacted] Mensuration Studies have indicated that human "pointing error" can be greater than the allowable error for the instrument being calibrated. Because of these facts, efforts have been expended to develop a Center capability for calibration in the submicrometer area, more specifically, for a submicrometer calibration device to provide support for calibration checks of the HPSC. This requires the development of a new technology.

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4. In response to this requirement, a contract was let with [redacted] for the development of an experimental calibration device. This de-

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Declass Review by NIMA/DOD

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vice operates essentially by performing an automatic scan of a calibrated scale by means of a miniaturized electro-mechanical-optical system. A null meter tells the operator when the comparator microscope is exactly centered on the calibrated scale marking, thereby eliminating human error from the system. The goals of this development were two fold: first, to provide certified, thermally stable scales accurate to ½ micrometer that are traceable to, and certified by, the National Bureau of Standards; and second, to provide an electronically centered error detector to help remove the operator uncertainty from the calibration system. Despite the fact that this development will not be ready in time for the initial testing of the HPSC in early 1971, an operating prototype calibration device (based on the concepts developed under this contract) can be manufactured in mid 1971 for regularly scheduled calibration checks to insure the continued stability and reliability of the equipment.

5. Originally, a three-phased fifteen-month program was proposed for the development of the required final prototype calibrator. However, only Phase I was initially approved. This was for fabrication of the Experimental Calibrator and for testing on a GFE microscope assembly at the contractor's facilities. This part of the development has essentially been completed. The experimental unit has been successfully demonstrated; and the operational procedures, as well as the electronic principles involved, have been fully established. The three quality scales are in the process of being calibrated and certified by NBS.

6. The development is now ready for Phase II, which consists of Task I and Task II. These two tasks consist of: (1) testing the experimental device on the HPSC and the data analysis of these tests; and (2) the design, construction, and testing of the final Prototype Calibration Device. The basic theory of this development has been proven in Phase I. The question is not whether the device will operate, but how well the final version will perform. Hence, the technical risk involved in this project is relatively low.

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7. Since this contract is based upon the previous development of the experimental device, now to be followed by prototype equipment, the follow-on effort will be handled as a sole source item. Successful completion of Phase II, the actual fabrication of the final Prototype Calibrator, will require an additional seven-month effort. Since there is only one HPSC, there will be no need for additional devices of the same configuration. However, this technique appears highly adaptable for use with less precise comparators in the building.

8. The security classification of this contract will be CONFIDENTIAL. The association is CONFIDENTIAL, and the title and work is UNCLASSIFIED.

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[redacted]

Chief, Technical Services Group,
NPIC

Attachments:

1. Proposal
2. Form 2420

APPROVED: _____ Date

ARTHUR C. LUNDAHL
Director,
National Photographic Interpretation Center

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